

# Climate Literacy and Energy Awareness Network (CLEAN)

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## Introduction

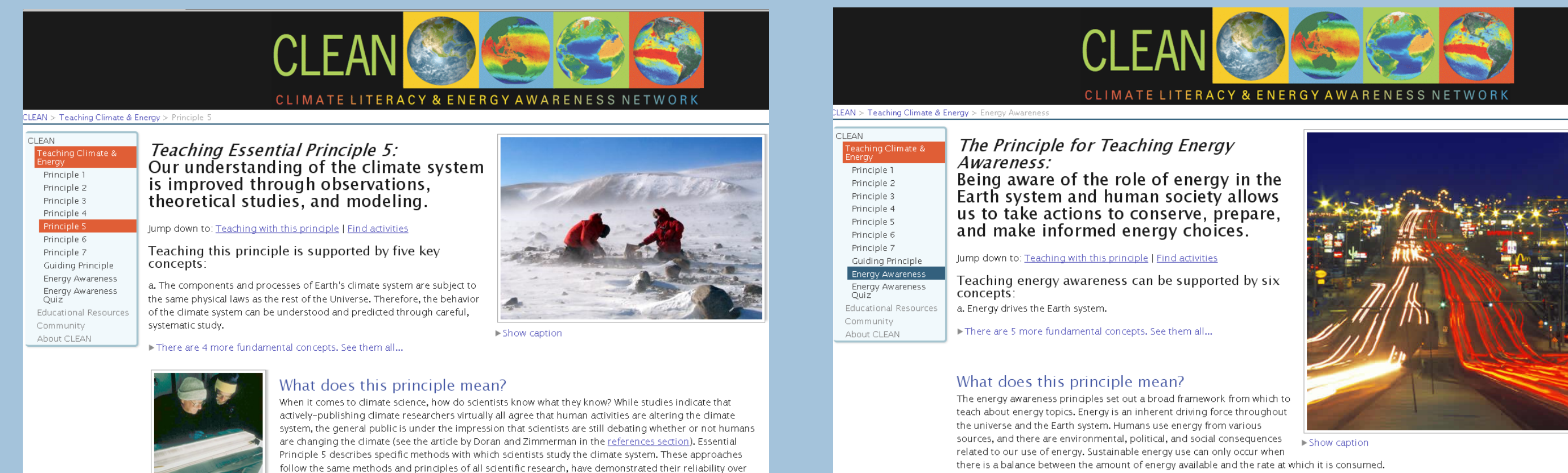
To provide students with accurate information about climate and energy science, educators require scientifically and pedagogically robust teaching materials. This is especially important for topics in which scientific understanding is rapidly evolving and for educators who have not had formal training in climate science. To address this need, the CLEAN Pathway (<http://cleanet.org>), a National Science Digital Library (<http://www.nsdli.org>) project, is building and stewarding a collection of materials for teaching climate and energy science appropriate for grades 6-16. Review criteria and a rigorous review process have been developed to vet classroom activities, lab demonstrations, visualizations, simulations and more. We are looking to work with resource developers, in a peer review process, to include their climate and energy educational resources in the CLEAN collection.

The CLEAN collection currently contains 330+ vetted climate and energy science educational resources aligned with the AAAS Project 2061 Benchmarks for Science Literacy. The effort also includes guidance for teaching about climate and energy, professional development opportunities for secondary teachers and undergraduate faculty, and a mechanism for other programs to bring CLEAN resources into their web sites.

## Teaching Climate and Energy Topics Webpages

<http://cleanet.org/clean/literacy>

The CLEAN website offers background information and teaching tips for educators of students in grades 6-16 for teaching climate and energy concepts. We follow a **literacy-based approach**, using the framework provided by the Climate Literacy Essential Principles of Climate Science and Energy Awareness. For each of the principles, we summarize the relevant **scientific concepts** and provide a more detailed discussion of what makes the **topic important**, and why it can be **challenging to teach**. We offer suggestions for grade-level specific **teaching strategies** and links to **relevant teaching and reference materials**.

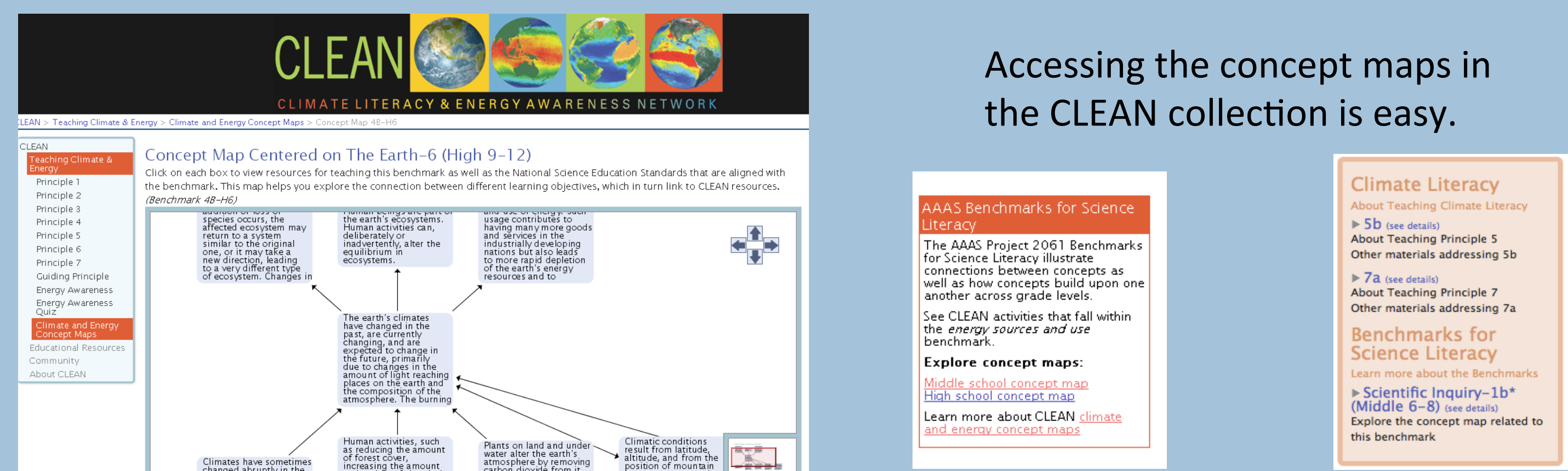


Two examples of "Teaching Climate and Energy" Pages on the CLEAN Website (cleanet.org).

## Climate and Energy Concept Maps

[http://cleanet.org/clean/literacy/concept\\_maps.html](http://cleanet.org/clean/literacy/concept_maps.html)

To help educators explore how climate and energy topics can be organized into a **logical scope and sequence**, we present the CLEAN collection in a tool that visually connects CLEAN resources with relevant benchmarks from the **AAAS Project 2061 Benchmarks for Science Literacy**. These concept maps can also be used to plan lessons around climate science and energy awareness.



Screenshot of one of the concept maps showing the climate related concepts for the high school benchmark "The Earth"

From each Teaching Climate and Energy Web Page

From the CLEAN description of each resource

## The CLEAN Review Process

<http://cleanet.org/clean/about/review.html>

We have designed a **rigorous and transparent peer-review process** for the CLEAN collection. A peer-review process is desirable for curriculum developer as well as collection builder to ensure quality of the collection, and its implementation is non-trivial. Our experiences provide general guidelines that can be used to judge the quality of digital teaching materials across disciplines.

We have instituted a multi-stage review process. The steps in this process include:

### 1. Identification of teaching materials

Our team of CLEAN resource collectors searches educational websites to find existing digital teaching resources that are a) **relevant to CLEAN** given the above defined framework of climate science, climate change, and energy awareness, b) of **appropriate granularity**, and c) for the **appropriate grade level**. We are evolving this process to include direct interactions with resource developers who will submit their resources to a peer-review. This will involve an iterative process with authors much like a peer-reviewed journal.

### 2. Formal Triage/Vetting

Any teaching resource that seems relevant to the collection, with a promising pedagogic design and seemingly solid science, is entered in our **online review tool** for further consideration by the review team. The questions in our initial vetting form address the **relevance of the resource to the collection (topic, type of educational material, grade level)** and conclude with a qualitative recommendation of the overall quality of the resource.

### 3. Reviews

**General Reviews:** Review criteria have been developed for **activities, videos, visualizations, and demos/short investigations**. These include criteria for a) **scientific accuracy**, b) **pedagogic effectiveness**, and c) **technical quality/ease of use**. Two general reviews are conducted for each resource, with the reviewers providing an overall assessment of high, medium, or low priority. Those with a combination of high and medium priority move on to the next round.

**Panel Review:** Resources that pass the two rounds of general review are presented to a **panel of four reviewers (educators and scientists)** during a review camp. This team of four specialists discusses each resource, based on the prior reviews, and makes the final decision about inclusion in the CLEAN collection.

**Expert Science Review:** Climate and energy science encompasses a very wide range of disciplines, exceeding the scientific expertise of the CLEAN team. Therefore, an expert science review is conducted for resources that pass the panel review.

Comments from all reviewers, along with teaching tips, are compiled in annotations (notes to the user) that are included when cataloging the resource in the collection. Resources that include cutting edge science are flagged. They will be re-reviewed as science evolves.

### 4. Cataloging and alignment with benchmarks/standards/guidelines

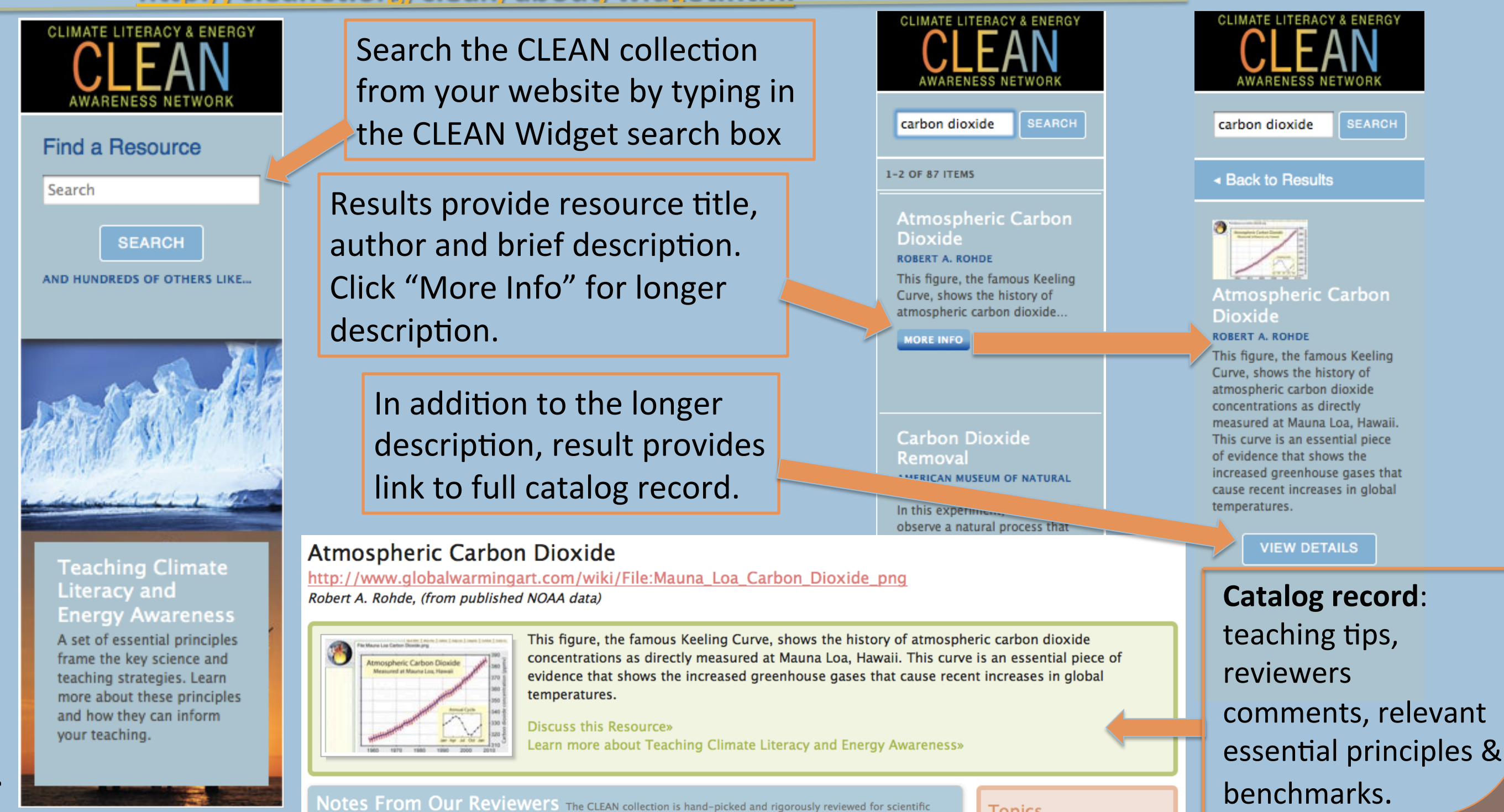
The CLEAN team developed a set of terms ("vocabularies") that define the topics of climate science, climate change, and energy awareness. CLEAN resources are aligned with the Climate Literacy Essential Principles of Climate Science at the concept level as well as with Energy Awareness principles. The CLEAN collection is also aligned with the Benchmarks for Science Literacy (AAAS Project 2061). CLEAN Selected resources are **cataloged into the collection by tagging with the vocabularies, climate and energy principles, benchmarks, and including comments from all of our reviewers**. Resources will also be aligned with the National Science Education Standards and the NAAEE Excellence in Environmental Education Guidelines.



Logo provided to CLEAN selected resources

## Bringing CLEAN Resources to Your Website: The CLEAN "Widget"

<http://cleanet.org/clean/about/widget.html>



Would visitors to your website benefit from direct access to a collection of climate and energy related teaching materials rigorously reviewed by scientists and practicing educators?

With the **CLEAN widget** you can **embed access to CLEAN's collection of resources directly into your website**.

The CLEAN widget is a simple piece of javascript code that presents a self contained search of the CLEAN collection of climate and energy educational resources.

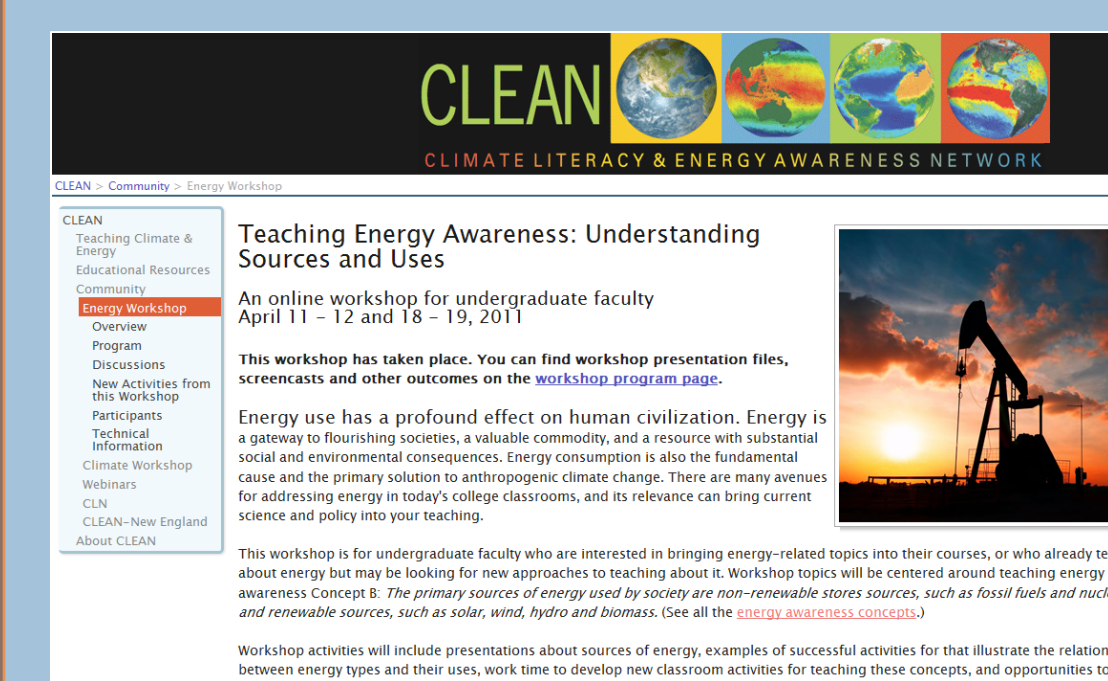
## Educator Professional Development

## Interactive Online Workshops for College Faculty

<http://cleanet.org/clean/community/workshops>

CLEAN offers online workshops focused on **teaching climate and energy topics for undergraduate faculty**. Each workshop runs over 4 days with a blend of synchronous sessions and asynchronous work time. Workshop activities include **presentations about the science**, examples of **teaching resources from the CLEAN collection** proven to be successful in the classroom, work time to **develop new classroom activities** for teaching the science concepts, and opportunities to **collaborate and network** with other faculty.

### Teaching Energy Awareness: Understanding Sources and Uses



These two online workshops were designed to help college science faculty strengthen their teaching of climate and energy topics by:

- building content knowledge of climate and energy topics
- demonstrating exemplary teaching materials in the CLEAN collection
- collaborating with other faculty to develop new classroom materials

### Navigating Climate Complexities in the Classroom



### Outcomes

- 12 new activities were completed and peer-reviewed by participants
- A new model emerged for teaching a principle of climate literacy with an integrated suite of activities
- Faculty networking and collaboration was fostered across the science disciplines.

### Upcoming Workshops

Communicating Climate Change - April 2-11, 2012  
Interactions within the Climate System - May 7-16, 2012

## Interactive Webinars (iWebinars) for Secondary Level Educators

<http://cleanet.org/clean/community/webinars>

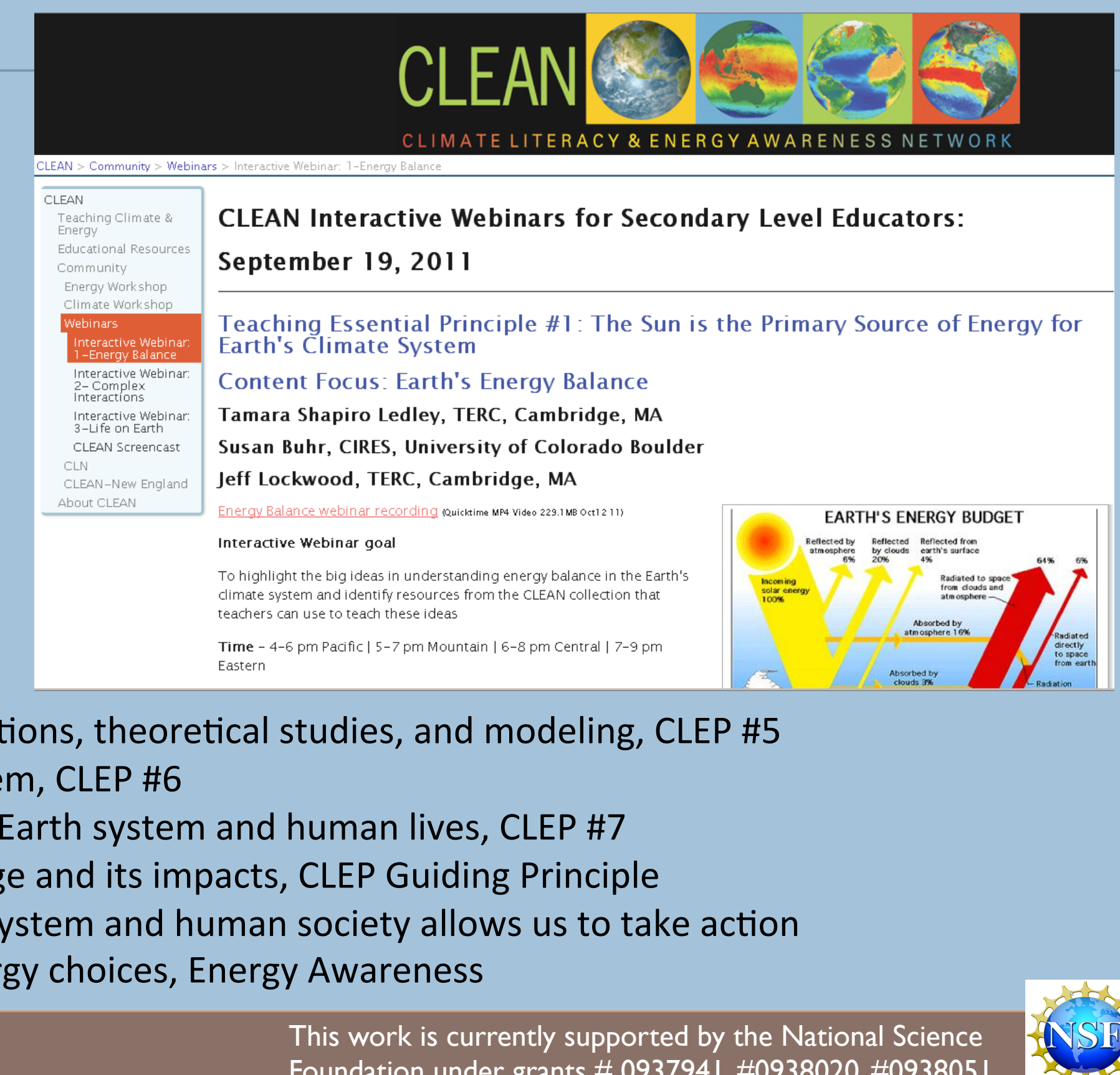
CLEAN offers monthly interactive 2-hour webinars for **middle and high school educators**. Each webinar focuses on one of the **Climate Literacy Essential Principles (CLEP)**. Webinar presenters explore **misconceptions** that exist around the content, present the **scientific background**, and suggest **how to teach** the content of the respective principle from an educator perspective. Participants discuss, in **interactive breakout sessions**, how the **CLEAN collection can support them in their teaching**. Presenters are scientists and educators with an expertise in the respective topics covered.

### Examples of Topics Covered in iWebinars

- Overview of Climate Literacy Essential Principle or Energy Awareness principle that is the focus of the iWebinar
- Big ideas and student misconceptions
- Discussion of effective strategies for teaching these ideas
- Identification of selected teaching resources from CLEAN collection that address the topic

### 2011-2012 iWebinar Series

Sept 19, 2011: Energy Balance, CLEP #1  
Oct 19, 2011: Complex Interactions, CLEP #2  
Nov 15, 2011: Life on Earth, CLEP #3  
Dec 15, 2011: Climate Varies over Time and Space, CLEP #4  
Jan 19, 2012: Our understanding is improved through observations, theoretical studies, and modeling, CLEP #5  
Feb 16, 2012: Human activities are impacting the climate system, CLEP #6  
Mar 15, 2012: Climate change will have consequences for the Earth system and human lives, CLEP #7  
Apr 17, 2012: Humans can take action to reduce climate change and its impacts, CLEP Guiding Principle  
May 15, 2012: Being aware of the role of energy in the Earth system and human society allows us to take action to conserve, prepare, and make informed energy choices, Energy Awareness



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